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DistilWise IoT: A Smart Industrial Wastewater Treatment innovation by UMPSA researchers

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PEKAN, 16 July 2025 – A team of researchers from the Faculty of Civil Engineering Technology (FTKA), Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), led by Associate Professor Dr. Nadzirah Mokhtar, has successfully developed an innovative water treatment system that integrates membrane distillation technology with the Internet of Things (IoT).

Acknowledging the growing role of digital technology in enhancing efficiency and sustainability in industrial water treatment, Dr. Nadzirah introduced a breakthrough product titled DistilWise IoT: Compact Membrane Distillation with IoT Monitoring System after two years of dedicated research.

The project was fully funded through an internal research grant from UMPSA.
Dr. Nadzirah's innovation underscores the ability of local researchers to produce high-impact solutions that meet real-world industrial needs.
The product has already earned multiple accolades, including a Gold Award, Special Award, and Best of the Best Award at CITREX 2024, and a Silver Award at ITEX 2025.

"As a researcher in membrane technology, water and wastewater treatment, and energy and environmental studies, I was inspired to explore this solution after working on an irrigation system project for oil palm plantations.

"Collaborating with fellow researchers, she began to see the immense potential of IoT technology in industrial wastewater applications.

"IoT can significantly reduce the reliance on manual monitoring, which often requires staff to be physically present on-site," she said.

She explained, in industrial wastewater treatment, real-time monitoring and process control are absolutely critical.
From this realisation, the idea for a smart and remotely monitored treatment system was born.

DistilWise IoT incorporates a compact membrane distillation system using a custom-developed hollow fibre membrane made from a blend of polyvinylidene fluoride (PVDF) and bentonite.

This combination allows the membrane to withstand high temperatures and harsh chemicals commonly found in industrial wastewater, enabling it to remove up to 99% of contaminants efficiently.

“One of the key strengths of this product is the membrane’s filtration capacity and durability.

“We developed and tested the material entirely in-house,” she said.

Performance tests using real wastewater samples from FGV Lepar Hilir 2 palm oil mill and Mardec rubber mill in Mentakab demonstrated the system’s high pollutant removal efficiency, making it highly suitable for commercial industrial use.

The system is supported by a network of sensors and actuators connected to an IoT platform, allowing users to monitor its performance remotely via mobile devices.

“It also features anomaly detection and automatic alerts through a Telegram Bot, so users can be notified immediately if any irregularities or malfunctions occur.

“Imagine water treatment plant managers being able to check temperature, pressure, or membrane performance directly from their smartphones without needing to be on-site,” she added.

This not only improves operational efficiency but also facilitates proactive maintenance planning.

Dr. Nadzirah also shared plans to further enhance the system to be fully autonomous and powered by solar energy, making it more sustainable and ideal for rural applications.

“There is strong potential for this system to be adapted into small-scale clean water treatment units for rural communities, particularly in areas with limited access to safe drinking water.

“With a simpler design and reduced cost, this technology could literally be life-saving,” she said.

The system’s estimated development cost is around RM10,000 and making it one of the most affordable smart water treatment solutions available in the market.

In addition to DistilWise IoT, Dr. Nadzirah has also developed two other membrane-based products: MDSolution and MDSolares.

Her work reflects UMPSA’s dedication to research that not only advances academic knowledge but also delivers practical, impactful solutions to pressing challenges faced by industries and communities alike.

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